What is claimed:

1. A monolithic single pass expanded beam mode active optical device for light of a predetermined wavelength and a predetermined beam mode, comprising:

a substrate including a top substrate surface;

a waveguide layer coupled to the top surface of the substrate and including;

a semiconductor gain medium;

two expansion/contraction sections, each including a portion of the semiconductor gain medium which is substantially transparent to light of the predetermined wavelength wherein, at least a portion of the semiconductor gain medium varies in thickness within said expansion/contraction portion of the expansion/contraction section; and

an active section extending between the two expansion/contraction sections the active section including an active portion of the semiconductor gain medium which interacts with light of the predetermined wavelength, responsive to the electric signal;

a semiconductor layer coupled to the waveguide layer;

a first electrode coupled to the substrate; and

a second electrode coupled to the semiconductor layer,

wherein the first and second electrodes are configured to receive the electric signal.

2. A monolithic expanded beam mode active optical device according to claim 1, wherein the semiconductor gain medium is a bulk active semiconductor material.

3. A monolithic expanded beam mode active optical device according to claim 1, wherein the semiconductor gain medium is a quantum well structure formed of a plurality of sublayers of semiconductor material.

4. The monolithic expanded beam mode active optical device of claim 3, wherein:

the waveguide layer further includes;

two input/output surfaces, each substantially perpendicular to the top substrate surface;

a longitudinal axis extending between and substantially perpendicular to the two input/output surfaces;

each of the plurality of sublayers extends;

substantially parallel to the top surface of the substrate in a direction perpendicular to the longitudinal axis; and

from one of the two input/output surfaces to an other one of the two input/output surfaces; and

each of the two expansion/contraction sections and the electroabsorption section extend along the longitudinal axis adjacent to one of the two input/output surfaces.

5. A monolithic expanded beam mode electroabsorption modulator for modulating light of a predetermined wavelength, including a quantum well structure responsive to an electric signal having an on-voltage and an off-voltage, comprising:

a substrate including a top substrate surface;

a waveguide layer coupled to the top surface of the substrate and including;

two expansion/contraction sections, each including a plurality of sublayers, which form the quantum well structure, wherein the quantum well structure in the expansion/contraction sections has a thickness which varies within said expansion/contraction section and defines an expansion/contraction cutoff wavelength which is shorter than the predetermined wavelength; and

an electroabsorption section extending between the two expansion/contraction sections and including a portion of the quantum well structure having, responsive to the on-voltage of the electric signal, a first electroabsorption cutoff wavelength which is shorter than the predetermined wavelength; and, responsive to the off-voltage of the electric signal, a second electroabsorption cutoff wavelength which is longer than the predetermined wavelength;

a semiconductor layer coupled to the waveguide layer;

a first electrode coupled to the substrate; and

a second electrode coupled to the semiconductor layer wherein the electric signal is applied between the first and second electrodes.

6. A method of manufacturing a monolithic expanded beam mode electroabsorption modulator which includes a substrate with a top surface and substrate index of refraction; a waveguide layer with a two expansion/contraction sections and an electroabsorption section arranged along a longitudinal axis; and a semiconductor layer, the method comprising the steps of:

a) forming at least one patterned growth retarding layer on the top surface of the substrate

b) forming a waveguide layer having a waveguide index of refraction different from the substrate index of refraction on a portion of the top surface of the substrate by selective area growth, the waveguide layer including;

an electroabsorption portion having an electroabsorption thickness which is greater than thicknesses in other portions of the waveguide layer; and

a plurality of sublayers forming a quantum well structure, each of the sublayers including a waveguide material;

c) forming the semiconductor layer on the waveguide layer, the semiconductor layer including a semiconductor layer index of refraction different from the waveguide index of refraction;

d) defining and etching the waveguide layer and the semiconductor layer;

f) planarizing the semiconductor layer;

g) depositing a first electrical contact on the substrate; and

h) depositing a second electrical contact on the semiconductor layer.

7. The method of claim 6, wherein the step of forming the patterned growth retarding layer includes forming a plurality of growth retarding elements, the growth retarding elements defining a channel extending along a central portion of the longitudinal axis, wherein the channel has a width greater than the electroabsorption width.

8. The method of claim 6, wherein step d) further includes the step of removing the growth-retarding layer.

9. An optical signal modulation system comprising;

a laser which produces a light beam with a predetermined wavelength and a first beam mode;

a monolithic expanded beam mode electroabsorption modulator including;

an input surface optically coupled to the laser and substantially optimized for low input loss of light beams with the first beam mode;

an expansion section to expand a beam mode of the light beam for increased confinement of the light beam;

an electroabsorption modulation section including a quantum well structure for modulating light of the predetermined wavelength;

a contraction section to contract the beam mode of the light beam to a mode which approximates the first beam mode; and

an output surface; and

an optical fiber optically coupled to the output surface of the monolithic expanded beam mode electroabsorption modulator and substantially optimized for low input loss and for transmission of light beams with the first beam mode.

10. An extended range optical communication system comprising;

a laser which produces a light beam with a predetermined wavelength and a first beam mode;

a first optical fiber for transmission of light beams with the predetermined wavelength and the first beam mode, including an input end optically coupled to the laser and an output end;

a monolithic expanded beam mode optical amplifier including;

an input surface optically coupled to the output end of first optical fiber and substantially optimized for relatively low input loss of light beams with the first beam mode;

an expansion section to expand a beam mode of the light beam for increased confinement of the light beam;

an optical amplification section including a semiconductor gain medium for amplifying light of the predetermined wavelength;

a contraction section to contract the beam mode of the light beam to approximate the first beam mode; and

an output surface; and

a second optical fiber optically coupled to the output surface of the monolithic expanded beam mode optical amplifier and substantially optimized for low input loss and transmission of light beams with the first beam mode.

11. An extended range optical communications system according to claim 10 wherein the semiconductor gain medium includes a bulk active material.

12. An extended range optical communications system according to claim 10 wherein the semiconductor gain medium includes a quantum well structure.

13. A low-loss demultiplexer in a temporally multiplexed optical communication system for demultiplexing an input signal including a plurality of channels, each channel modulated at a channel bit rate and temporally offset from other ones of the plurality of channels by less than a minimum time between bits, comprising;

an input optical signal source;

a monolithic expanded beam mode electroabsorption modulator including;

an input surface optically coupled to the input optical signal source and substantially optimized for low input loss of the input signal;

an expansion section to expand a beam mode of the input signal for increased confinement of the input signal;

an electroabsorption modulation section including a quantum well structure for modulating light of the expanded input signal to select one channel of the input signal by periodic modulation at the channel bit rate and temporal offset of the selected channel;

a contraction section to contract the beam mode of the selected channel of the input; and

an output surface; and

a receiver optically coupled to the output surface of the monolithic expanded beam mode electroabsorption modulator to receive the selected channel of the input signal.

14. A low-loss demultiplexer for demultiplexing a time division multiplexed optical signal including a plurality of channels, each channel transmitted as blocks of pulses which are temporally interleaved with blocks of pulses of other channels, comprising;

an optical beam splitter for splitting the time division multiplexed optical signal into a plurality of split optical signals;

a monolithic expanded beam mode electroabsorption modulator including;

an input surface optically coupled to one of the split optical signals of the optical beam splitter and substantially optimized for low input loss of the one split optical signal;

an expansion section to expand a beam mode of the one split optical signal for increased confinement of the one split optical signal;

an electroabsorption modulation section including a quantum well structure for modulating light of the expanded one split optical signal to select blocks of a first channel of the one split optical signal;

a contraction section to contract the beam mode of the selected first channel blocks; and

an output surface; and

a buffer optically coupled to the output surface of the monolithic expanded beam mode electroabsorption modulator to store the selected first channel blocks.